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NEW REQUIREMENTS FOR ENTRANCE AND GRADUATION AT THE UNIVERSITY OF CHICAGO

THE University of Chicago faculty has just adopted a new plan for entrance to the colleges and a new set of requirements for graduation with the baccalaureate degree, which represent the results of some two years or more of careful study. The original motives for the investigation were several. On the one hand, it was felt that the university was in some essential particulars losing touch with the secondary schools from which its undergraduate student body is recruited. This feeling was not based upon loss of numbers, for these have steadily increased, but in part upon the expressions of the principals and teachers in these schools, and in part upon the considerable number of conditioned students who were received year by year. On the other hand, the faculty has been called upon constantly to consider requests from students to be relieved from certain of the requirements for the bachelor's degrees. The character of these requests made it clear that to some extent at least the curricula of the university were not meeting the reasonable needs of students, nor contributing in the most effective way to their serious education. Too little opportunity was afforded to meet the demands of training for special careers lying outside the usual forms of business and the learned professions. Especially was this maladaptation recognized in the case of women students, for whom it seemed at times desirable to devise special courses of study designed to fit them for particular lines of work. Other matters

might be mentioned which were responsible for the original determination to study the entire situation, but these will suffice to indicate the points of departure. As the work progressed it became increasingly evident that nothing short of a drastic reconstruction of the whole principle upon which the requirements of the university were based would adequately meet the necessities of the case.

For a number of years past the university has maintained a list of approved schools from which it admits students upon proper certification. The test which the schools have been obliged to meet has been that of personal inspection by a competent examining officer. This will still be the practise when a school is put upon the list for the first time. This is substantially the system in general use throughout the central portions of the country. The university proposes now to make a radical departure which involves shifting the emphasis from the examination of the school to a test of its work as judged by the records of its students after they come to the university. From this time on carefully tabulated records will be kept, showing the work of each student. The authorities of the school from which he comes will be periodically informed of these records and the teaching in the school will be judged accordingly. As an interesting supplement to this plan, it is hoped from time to time to bring teachers from the approved schools to the university to visit those classes which continue the work done in the schools. In this way it is expected to bring about a more intelligent cooperation than has hitherto been possible. Ordinarily the college inspects the schools. We propose, in addition to this, that the schools shall inspect the college. We believe that if this be done in the cordial spirit which has hitherto characterized our relations to the schools, both the university and the schools will be markedly benefited.

The university appreciates the vital significance of the development which has been in progress in the high schools of the country during the last decade. It sympathizes most cordially with the effort which these schools have been making to furnish, each to its own community, those things most essential to the betterment of the life of that community. It recognizes that amid the enormous variety of conditions in American life, schools in different localities, even schools in different portions of the same city, may face obligations in certain essentials widely divergent, to meet which successfully must involve considerable variation in curricula and methods of work. The university desires to do nothing which will in any way thwart the fullest success of this tendency in the modern high school. The period of sheer dictation by the college to the high school is forever passed. Possibly there is at the present time a danger that the schools may, in their turn, attempt to dictate to the college. However this may be, the University of Chicago desires and intends to put itself in the position of cooperating in the most effective way with those high schools which are earnestly striving to meet the needs of their communities. It desires to leave them the utmost flexibility in the arrangement of their curricula compatible with the carrying forward by the university of solid and serious work, which obviously must have its foundation in the achievements of the school. The college entrance plan shortly to be described has this end as perhaps its most important aim.

In compensation for the increased flexibility which the new arrangement permits, the university hereafter will expect to ad-

mit no student with less than fifteen units of entrance credits. In other words, entrance with condition is to be abolished.

The most striking change in the actual character of the requirements—matters of principle apart—is found in the substitution of certain specifications regarding the *amount* of work which a student must bring to the university as counter-distinguished from the particular subjects in which the credits must be offered. The *quality* of the work we expect to test chiefly by the college record of the students. Hitherto, following the practise of most colleges, the university has designated so much of this subject, and so much of that, as a requisite for entrance. With a single exception, this type of requirement now gives way to a demand for a certain amount of concentrated and continuous work in subjects selected by the student, or by the school, from among the standard academic subjects taught in all high schools. The one stipulated subject which must be presented is English, and this is required on the ground of its unique relation to all other subjects in the curriculum.

Quoting from the requirements themselves:

> Students applying for entrance to the University of Chicago present by certificate from approved schools, or by examination, 15 units of entrance credits. Among these must be 3 units of English and in addition one principal group of 3 or more units, and at least one secondary group of 2 or more units. These additional groups may be selected from among the following subjects:
>
> 1. Ancient languages (Greek and Latin), it being understood that to make a group of 2 or of 3 units the work must be offered in a single language.
>
> 2. Modern languages other than English; to make a group of 2 or of 3 units work must be offered in a single language as under group one.
>
> 3. Ancient history, medieval and modern history, English history, United States history, civics, economics.
>
> 4. Mathematics.
>
> 5. Physics, chemistry, botany, zoology, general biology, physiology, physiography, general astronomy.
>
> Not less than 1 unit may be offered in either physics or chemistry. Any combination of the subjects within each group is permitted.
>
> Of the 15 units offered for entrance not less than 7 must be chosen from subjects in groups 1–5 (or 10 including English). Not less than one half unit may be offered in any subject.
>
> The remaining 5 units may be selected from any subjects for which credit toward graduation is given by the approved school from which the student receives his diploma; but Greek, Latin, French, German (and all modern languages other than English), mathematics, physics and chemistry, if offered, but not as above under 1 and 5, must each consist of at least 1 unit. Latin may not be continued in college unless at least 2 units be offered.

It will be noted that a student may be admitted without having taken any work in three of the groups, provided he has had enough work in the other two, and that the content of 5 units is left entirely to the secondary schools, the only restriction being that they accredit the work toward their own diploma. The university is confident that such freedom in admission will in no way impair the standard of its degrees, because for several years a rigid method of grading has been in force, by which inefficient students are inevitably eliminated very early in the course.

The first two years of the college course are designed to articulate in the most intimate way with the high school course, and to assure certain results by the end of the second year of college residence, such as may enable the student at, or before that time, to enter with the greatest advantage upon professional specialization of one kind or another, and to make certain that each student, whether consciously aiming at a particular vocation or not, shall before graduation have acquired a reasonable mastery of one or more fields of knowledge.

To secure an effective correlation of

the high school and the college work it is provided that throughout the first year of his college residence the student shall pursue one subject which he has pursued in the high school either for two or for three years, or which he has pursued throughout the whole of the final year of his school course. The student will be encouraged to choose the last alternative only in cases where it is fairly certain that this subject is to constitute one of the important lines of specialization in his college work. Were either of the first two alternatives adopted, which would perhaps most often occur, the result would be to assure by the end of the first year a considerable proficiency in some one subject. It will be remembered that the entrance requirements were designed primarily to assure the gaining of a satisfactory amount of concentration in some two or more lines of work without particular reference to the special subjects in which such concentration was demanded. The requirement just described for the first year of college is intended to carry forward this principle of concentration, and to secure the two-fold result of bridging the gap between the college and the high school in a subject with which the student is already reasonably familiar, and also to secure at a relatively early stage of the college course the intellectual advantages which are gained by a considerable mastery of some one topic.

The college requirements fall into two main groups; those which are to be fulfilled during the first two years of the course, and those which are to be fulfilled before graduation, and chiefly during the final two years of residence. For a number of years the university has conferred a title known as the associate's title upon students who have completed with a certain degree of excellence the first two years of the college course. This title will still be conferred in accordance with the following plan.

In conjunction with the requirements for the "continuation work" in the first year are those now to be described which extend over the first and second years. During this period two courses in English and one in public speaking must be taken. The student is also obligated so to arrange his work that either in the high school or in the first two years of college he shall have completed the equivalent of two units in each of the following four groups of subjects: (1) Philosophy, history, social science; (2) modern language other than English; (3) mathematics; (4) science, physical or biological.

The English requirement is simply a continuation of the one which the university has administered for a number of years, and which experience apparently justifies. It is designed primarily to equip the student with a satisfactory command over the written and the spoken form of his mother tongue.

The distributive "group" requirement is obviously designed to assure the possession by each student of at least a rudimentary acquaintance with each of the great typical fields of knowledge. It will be readily understood by those familiar with high school curricula, that a student in a well equipped school might easily fulfill this group requirement before entering college. If this be not done, however, the discrepancy must then be made good before the end of the second college year.

The requirement in modern language is intended to assure the student a practical reading knowledge of some one modern language. This capacity will be tested by suitable examinations in the case of students who enter the university with credits for the required amount of language; or the successful passing of an advanced

course with a standard of excellence distinctly above the passing mark will be regarded as satisfying the requirement.

In general, then, it is intended that by the end of the second college year the student shall have secured a reasonable mastery over some one field of the work which he brings in from the high school; that he shall have come in contact with all the main divisions of knowledge; and that he shall be in possession, for purposes of practical use in his work, of at least one of the modern languages other than English.

Requirements for the bachelor's degree, in addition to those for the associate's title, involve the completion by the student of a principal and a secondary sequence of coherent and progressive courses. The principal sequence must consist of nine such courses, each occupying either 48 or 60 hours of class work [double this amount in the case of laboratory courses]. The secondary sequence must contain six such courses in another subject. It will be understood that the student is obliged to present a full four years of work at a certain standard grade. It may also be added that should a student decide to choose one of his sequences in the subject which he pursued as a continuation course in his first year, the three courses taken at that time may be included in the total number required to make up the sequence. This requirement is intended to secure a high degree of specialization in at least one subject of the university curriculum, with a lesser degree of concentration in some secondary topic, which might often be distinctly supplementary to the first. The university has for a number of years had a nine major requirement for its S.B. degree, and its experience with this plan affords a high measure of confidence that the new proposals will prove extremely efficient in obtaining substantial results.

Under normal circumstances, students will be left slightly less than one third of their courses in high school and in college open to free election. The more judiciously the school course were arranged, the larger would be the number of free electives in college. Ordinarily not more than fifteen full courses may be taken in college in any one department.

When the principal sequence is taken in the department of science the S.B. degree is conferred. When it is in the modern languages, or the social and historical sciences, or in philosophy, the Ph.B degree is conferred. The A.B. degree is conferred when the two sequences are respectively in Latin and Greek. In this case the exact amount required varies somewhat from the other instances, and the requirement must be in part fulfilled in the preparatory school. The general plan, however, is exactly the same as in the case of the other degrees, and the detailed provisions need not be explained in this place. The university has conferred these three degrees for a number of years.

A large number of alternative sequences will be worked out, designed to meet in the most effective way a variety of student needs. Students contemplating a professional career in law or in medicine will have sequences offered to them prepared with special reference to these professions. The same thing will be done for students whose needs are of a different character. It is also contemplated that any student who is able to present to his dean at an early stage in his college work sequences of an educationally defensible kind, other than those prepared by the faculty, may, upon securing permission from the college board, be allowed to pursue such courses. It is hoped that in this

way adequate provision may be made for the larger vocational interests represented by college students of serious purpose and well matured plans. An inspection of the provisions will at once make clear that the conception of vocational training is broad and catholic, and not in any way to be identified with the occasionally narrow and shallow training afforded by so-called vocational schools.

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The University of Chicago

THE MAN OF SCIENCE AND HIS DUTIES[1]

I have been laboring with some uncertainty, in an effort to determine what would be most suitable for an occasion of this kind. Shall I read a text, or shall I sound a key-note? Perhaps either or both would be in harmony with the occasion. For it is the aim of this society to promote what I consider the highest interests of mankind. We are to give every possible encouragement to those who seek to widen the boundaries of human knowledge. The world is beginning to learn how all-important it is that this should be done. We no longer need to spend any time in contending for such ideas. We only need to ask the doubter to read history, and to open his eyes to his surroundings. The boundary of human knowledge has been widening in a way that must excite our wonder. Like the four sages, of whom Dante has given us a beautiful picture, we stand in the hemisphere of light that has been kindled in our midst, and which slowly pushes back the surrounding darkness. But this only serves to reveal, more and more, the immensity of the region of darkness which still lies beyond. I wish to emphasize on every proper occasion, and certainly on this occasion, that the men who have earned and deserve the peculiar and special gratitude of their successors, are the men who could by no means foresee the value of their work.

Think for a moment of what the world owes to Michael Faraday. He never suspected the value of his work. The most learned men of his day were interested in his results, but they could not foresee their value. He was a man who had none of the advantages which a college student of to-day so often neglects. The son of a blacksmith, he was apprenticed to a bookbinder. While at this labor, he attracted the attention of Sir Humphry Davy, who was in charge of the laboratories of the Royal Institution. And this institution, by the way, was founded by a former teacher in a New England school, who became Count Rumford, and who was one of the greatest men that America has produced.

Faraday became the assistant of Davy, and he remained in the institution for fifty-four years. At the age of forty-two his merits were recognized by the governing board, in an action which relieved him of all lecture and instruction work. This was also a recognition of an obligation which they owed to the world.

Consider the results of one fragment of his work: On September 22, 1831, two years before he was relieved of instruction duties, Faraday wrote in his note-book as follows:

> I have had an iron ring made (soft iron), iron round and ⅞ of an inch thick, and ring six inches in external diameter. Wound many coils of copper round one half of the ring, being separated by twine and calico. There were three lengths of wire, each about 24 feet long, and they could be connected as one length or as separate lengths. By trial with a trough, each was insulated from the other. We will call this side of the ring *A*. On the other side, but separated by an interval, was wound wire in two pieces, together amounting

[1] Address of the president of Washington Chapter Sigma Xi.

to about 60 ft. in length, the direction being as with the other coils. This side call *B*.

Charged a battery of ten plates, four inches square, made the coil on *B* side one coil, and connected its extremities by a copper wire passing to a distance and just over a magnetic needle (three feet from iron ring). Then connected the ends on one of the pieces on *A* side with the battery: immediately a sensible effect on needle. It oscillated, and settled at last in original position. On breaking connection of *A* side with the battery, again a disturbance of the needle.

Later he varied the experiment and writes:

In place of the indicating helix, our galvanometer was used, and then a sudden jerk was perceived when battery communication was *made* and *broken*, but it was so slight as to be scarcely visible. It was one way when made and the other way when broken, and the needle took up its natural position at intermediate times.

The device which Faraday described was a transformer. The impulses which he saw in the needle were due to induced currents. He was at once led by this to the invention of the first dynamo, which he constructed during the same month.

If any person had asked Faraday that exasperating question, what is all this worth in pounds, shillings and pence, or what are your services really worth per student hour, he would have been utterly unable to make a satisfactory reply. The effects were so minute that it was with difficulty that they could be seen. The forces involved were utterly insignificant. His dynamo was worthless as a machine. Who could then have imagined that these feeble impulses would some day be pumped through wires to light large cities, and to move heavy cars loaded down with passengers? Who could have then believed that articulate speech would ever be transmitted by them? Who could then have believed that ships on the ocean would some day be in constant communication with the land, by means of such impulses transmitted through space, and that a ship in distress would thus be able to call for help? Had any prophet foretold all of this at that time, it would have been called the idle fancy of a foolish brain. And yet all of these great things followed directly from those simple experiments.

And the end is not yet. We are beginning to see the importance of saving our fuel. We may be able to grow trees, but we can not grow coal. An age of water power is before us when vast amounts of power will be thus obtained, and transmitted, by these methods devised by Faraday, to distant cities. Millions upon millions of dollars are now invested, and vast armies of men are employed in enterprises which followed directly from these simple experiments.

When Helmholtz visited London in 1853 he wrote to his wife an account of his visit to Faraday, in which he says:

Those were splendid moments. He is as simple, charming and unaffected as a child; I have never seen a man with such winning ways. He was, moreover, extremely kind, and showed me all there was to see. That indeed was little enough—for a few wires and some old bits of wood and iron seem to serve him for the greatest discoveries.

It is often said that work of such character is not for all; that only a few of the elect are capable of doing it. In a sense this is true. There are comparatively few who will in their younger days submit to the agonizing struggle through which one must go, in order that he may gain control of his mental faculties. If he is mentally slow in his sense perception, it will be necessary for him to engage, persistently, for hours, days and years, in a mental struggle with problems which tax his utmost powers. It is in this way that one finally acquires the capacity for careful and logical and persistent thinking. It goes without saying that there are comparatively few who will submit to such an

initiation. Certainly the average man is not and never has been of that class. Such men are thinking men. In their younger days most men are disposed to criticize the work of others. Among men of science this is much less common than it was thirty or forty years ago. Every one who has ever accomplished anything will recognize the truth of Goethe's remark:

> It is easier to recognize error than to find truth. That lies upon the surface so that it is easily dealt with; this rests in the depths, to search for which is not every man's affair.

As one's powers develop and he begins to attack constructive work, and to make mistakes, he begins to take less interest in searching for errors in the work of others. To search for truth is any man's affair who chooses to do so. And history tells us in no uncertain way that human development has always resulted from the efforts of those who have expended most of their energy in independent thinking. Sometimes the world has followed slowly. Sometimes the results have only become apparent in succeeding generations. Our industrial development has, however, always followed in the pathways marked out by scientific men. Their work has always preceded the work of the engineer and the inventor. And in the words of my text, When any nation has reached such a stage in its existence, that scientific discovery is put into the background as of no practical value, and the entire current of work is expended in engineering and business activity, that nation is on the way to the civilization of China.

As a nation we have before us problems that are vastly greater than any which have been solved in the past. We may assume that the future will take care of itself. We may assume that our leaders in thought and in knowledge will always be with us. We should, however, remember, that there have been former civilizations in other lands, of which no trace can now be obtained, without digging below the surface of the earth.

The question which should now interest us is, whether or not our civilization is to have such an ending.

It is only a century ago since one of my ancestors moved with his family from Vermont to the far west. There were few roads amid the immense forests through which they wandered, and in the midst of which the family finally found a home in central New York. I personally knew, and still remember the names of some of the men who developed that country. What they did was to chop down forests and burn them. What they then did should now be called by another name.

There are now among us men who are ambitious to waste the resources of the country, on the plea that they are developing those resources. They protest strongly against the importation of lumber from Canada, because it would interfere with the chopping down of our own trees. Fifty years ago there was not a locomotive engine in the country which was operated by coal fires. They were all operated by wood fires. The locomotive of to-day could not be operated by wood fires, and the wood is no longer available. Then a 100-ton locomotive would have been considered an impossibility. The bridges of that day would not have sustained them. At that time a 30-ton locomotive was in general use. Now we have locomotives which approach 300 tons. Thirty years ago the idea that 1,000 horse-power engines would be used for developing power to be distributed by electrical means was ridiculed as absurd by electrical authorities.

Even if we take the most liberal estimate of the amount of available coal yet unburned, and consider the enormous in-

crease in its consumption, we must still admit that the burning of coal is a mere incident in human history. It seems to me that it is the duty of thinking people to begin to think about such things. Why should they be left to those who are continually planning to perfect and legalize schemes of public robbery? The people of the country are waiting for leaders, who have been trained in methods of careful and logical thinking, who not only are not for sale, but who can not be bought, and who are not afraid.

There are other duties which are demanded of thinking men. It is evident that the honest public needs light on many questions which are of vital interest to all. It is possible to fool nearly half of the people, nearly all of the time. For example, there are many well-meaning people to whom it would never occur that the citizens of Missouri need protection against Iowa, or Arkansas, who can be made to believe that the people of the United States need protection against Canada, or Germany or England.

What we do need protection against, first of all, is organized systems of bribery and public robbery.

I know of men who have given attention to such public matters, who have engaged in a successful private business, and who among a wholly different class of men are regarded as authorities in some branch of scholarly or scientific work. The man who has scholarly tastes, the man who appreciates the value of those things which money can not buy, is not likely to be dominated by the insane greed which seems to have taken possession of such a large class of our citizens. He may appreciate the approval and gratitude of those whom he has helped, and to whom his life has been an inspiration. He is not dominated by a desire to attract attention. Certainly he will not seek to attract attention by spectacular or ostentatious waste of ill-gotten gains.

Perhaps we should not be far from the truth if we lay down as a fundamental axiom, that men's lives are guided by a desire to secure personal enjoyment or pleasure. The differences between men arise when we observe from their behavior, what it is that gives pleasure to them. Some will undergo hardships and distress, for the joy of attaining a worthy end. Some will spend their earnings for the pleasure of a midnight carouse. The searcher for the unknown in nature will spend years of labor and mental toil, in the hope that he may feel the joy of finally adding his mite to the store of knowledge which his predecessors have given to the world. Such work as this is often attended with a feeling which might properly be called mental distress.

In the twenty-fourth series of his "Experimental Researches" Faraday describes many tedious and intricate experiments in which he sought to discover some relation between electrical action and gravitation. As his biographer tells us, "He labored with characteristic energy for days, on the clock-tower of the Houses of Parliament and in the shot-tower of Southward, raising and lowering heavy weights connected with wire coils." Many times his results appeared for a time to furnish conclusive proof of his assumption. Then came a period of self criticism, and of doubt, and when the final end was reached, there remained absolutely no result. As Faraday described his mental condition, "Occasionally, and frequently, the exercise of the judgment ought to end in absolute reservation. We are not infallible, and so we ought to be cautious." On another occasion he said:

The world little knows how many of the thoughts and theories which have passed through the mind of the scientific investigator, have been crushed in silence and secrecy by his own severe criticism and adverse examination; that in the most successful instances, not a tenth of the suggestions, the hopes, the wishes, the preliminary conclusions have been realized.

It is a matter of common observation that men who have done most to widen the boundaries of human knowledge, are the ones who are most frequently in a state of doubt. They are always ready to take the whole matter into consideration again when some preliminary conclusion is confronted with conflicting evidence. In physics where we seek the relation between various values which are simultaneously involved in some function, as in the bending of a beam under a load, we can vary one quantity only, and find its effect on the result. When this has been done with all of the variables which are concerned, the entire equation involving the simultaneous effect of all the variables can be written. When we undertake to determine the effect upon a nation, of some national policy, we are never able to control conditions in two successive experiments. We can not eliminate the disturbing effect of other influences or conditions which have also changed and which are of importance in determining the result. But the political orator is never in doubt. He speaks with as much of assurance as a lawyer, who argues a case in court.

It is not the duty of a scientific man to defend what is generally believed to be the truth. The mental attitude of the advocate is foreign to every instinct that the man of science should possess. In Galileo's time we can well understand how the man of science should actively contend in quarrelsome debate with those who refused to look through his telescope. It was enough for them to know that there were seven openings in the head, seven metals, and seven days in the week. This was proof enough that there could only be seven planetary bodies. The moon and the sun were perfect as they came from the hand of the creator. This was proof enough that there could be no mountains and valleys on the moon, and no spots on the sun. It needs no telescope to settle such questions. That all bodies do not fall with the same acceleration has been already passed upon in a prior decision. It is sufficient to cite that opinion, and Galileo's experiment at the tower of Pisa counts for nothing.

Galileo was himself a product of an age characterized by ideas of this kind. In his day his mental attitude was perhaps needful. There are times when the soil must be plowed. In our time the man of science is free to go his own way in the pursuit of his work and in publishing it to the world. If one feels dissatisfied with the present, he can do nothing better than to read history.

I have often felt that scientific students of our time would be greatly benefited by reading much more of history than is their custom. There are some most interesting remnants of scientific history, connected with the Moorish occupation of Spain. The work of Alhazen, who lived about 1100 A.D. would have been creditable in any age. It requires great patience for one living in this age to read European history during the times of Luther and Galileo. It is, however, only in this way that we can realize what progress the world has been making.

It is, however, a satisfaction to know that nations have never been driven to bloody wars in order to enforce the doctrine of universal gravitation, or Kepler's third law, or the doctrine of evolution.

We do learn that in those earlier times,

a public official who would dare to interfere with princely schemes of public robbery, would generally lose his head. Now he at most loses his position. Our merchant princes are not so severe as their predecessors were.

The barber of the present day is not expected to do surgical work, although his sign still gives notice that accidents may happen. The bloody pole with its white bandage reminds us of the days when the barber was the surgeon. The family of Poisson decided for him in his youthful days that the work of a notary required greater intelligence than he possessed, and advised him to become a surgeon. It was not until 1745 that the "barberous" work of the surgeon and the surgical work of the barber were, in England, eliminated by law.

Not only should one study the history of the arts and sciences, but even more inspiring are the biographies of the great men of history. Most of the men who have given direction to scientific thought and work have been men who came from the most humble positions in life. Occasionally we find one coming from so-called higher levels, who was not satisfied to be simply a descendant. To read an account of the work of such men, in connection with the human element which enters into a biography, often opens up a new world to a young man. He may thus learn that he possesses elements which respond to such history. It is not saying too much to say that the great mass of students in college never come into contact with the great things of the learned world. They do not do enough of skirmishing in the fields of learning. They waste their time in trivial matters which will have little value to them in the future. They perhaps never acquire the faintest knowledge of branches of learning, which, if they knew of them, would change the whole current of their lives.

And in order that one may do new work it is not necessary to hunt for new fields. Remember that the Crookes tube was in physical laboratories in all parts of the world for seventeen years, before any one suspected that it was an X-ray tube. Röntgen was hunting for accidents of the kind, and he accidentally discovered that there were phenomena outside of the tube that demanded attention. It is only needful that one shall read and think, and the work of others, which may have been published half a century ago, will suggest something to you which it never suggested to any one before, and which may occupy your attention for years.

FRANCIS E. NIPHER

BRITISH VITAL STATISTICS

THE British Registrar-General has issued his return relating to the births and deaths in the first quarter of the year, and to the marriages during the three months ending December last. From the abstract in *The British Medical Journal* it appears that the marriage-rate during that period was equal to 16.1 per 1,000, or 0.7 per 1,000 less than the average rate for the corresponding quarter in the ten preceding years.

The 223,588 births registered in England and Wales during the quarter under notice were equal to an annual rate of 24.8 per 1,000 of the estimated population; the birth-rate last quarter was 2.7 per 1,000 below the average rate for the corresponding period of the ten preceding years, and is the lowest birth-rate recorded in the first quarter of any year since the establishment of civil registration. Among the several counties the birth-rates ranged from 17.8 in Carnarvonshire, 18.5 in Sussex, 19.6 in Northamptonshire, 20.1 in Kent, and 20.6 in Dorsetshire and in Gloucestershire, to 29.1 in Nottinghamshire, 31.3 in Carmarthenshire, 31.4 in Durham, 34.5 in Glamorganshire and 35.9 in Mon-

mouthshire. In seventy-seven of the largest towns, including London, the birth-rate averaged 24.9 per 1,000; in London the rate was 23.9, while among the other towns it ranged from 14.5 in Hastings, 15.1 in Hornsey, 16.0 in Bournemouth, 16.7 in Halifax, and 18.3 in Handsworth (Staffs), to 31.5 in Merthyr Tydfil, 33.6 in St. Helens, 35.3 in Coventry, 35.9 in Swansea, and 41.8 in Rhondda.

The excess of births over deaths during the quarter was 80,447, against 83,784, 68,281, and 85,256 in the corresponding quarters of the three preceding years. From a return issued by the Board of Trade it appears that the passenger movement between the United Kingdom and places outside Europe resulted in a net balance outward of 70,973 persons. There was an outward balance of 46,076 English passengers, 1,185 Welsh, 11,473 Scottish, 4,002 Irish, and of 8,812 foreigners, while there was an inward balance of 575 British Colonial passengers.

During the three months under notice the deaths of 143,141 persons were registered, equal to an annual rate of 15.9 per 1,000, or 1.7 per 1,000 less than the average rate for the corresponding quarter in the ten preceding years. The lowest county death-rates last quarter were 13.3 in Middlesex and in Essex, 13.5 in Kent, 13.6 in Leicestershire, 13.7 in Northamptonshire, and 13.9 in Worcestershire; the highest rates were 18.2 in Herefordshire, 18.5 in Devonshire, 19.0 in Monmouthshire, 19.6 in the North Riding of Yorkshire, and 20.2 in Carmarthenshire. In seventy-seven of the largest towns the corrected death-rate averaged 16.8 per 1,000; in 136 smaller towns the rate was 15.4 per 1,000, which was also the rate in the remainder of the country. The crude death-rates in the seventy-seven towns ranged from 7.6 in King's Norton, 8.5 in Hornsey and in Handsworth (Staffs), and 10.4 in East Ham, to 19.2 in Oldham, 19.3 in Dewsbury and in Swansea, 19.4 in Liverpool, 20.0 in Sheffield, 20.7 in Coventry, and 23.1 in Middlesbrough; in London the death-rate was 15.8 per 1,000.

The 143,141 deaths from all causes last quarter included 12,535 which were referred to the principal infectious diseases; of these, 6,147 were attributed to measles, 2,631 to whooping-cough, 1,439 to diarrhœa and arteritis (among children under two years of age), 1,369 to diphtheria, 515 to scarlet fever, 421 to enteric fever, 9 to small-pox, 2 to typhus, and 2 to pyrexia of uncertain origin.

The rate of infant mortality, measured by the proportion of deaths among children under one year of age to registered births, was equal to 115 per 1,000 or 15 per 1,000 less than the average rate in the ten preceding first quarters. Among the several counties the rates of infant mortality last quarter ranged from 88 in Sussex, 91 in Surrey, 93 in Dorsetshire, 94 in Hampshire and in Buckinghamshire, and 95 in Hertfordshire, to 130 in Cornwall, 138 in Cumberland, 144 in the North Riding of Yorkshire, 145 in Monmouthshire, and 164 in Carmarthenshire. In seventy-seven of the largest towns the rate averaged 115 per 1,000 (being equal to the rate in the country as a whole), and ranged from 57 in Hornsey, 65 in Wallasey, 79 in King's Norton and 80 in Hastings and in Great Yarmouth, to 149 in Sheffield and in Rotherham, 151 in Grimsby, 158 in Blackburn, 165 in Dewsbury and 186 in Middlesbrough.

The death-rate among persons aged 1 to 65 years was 8.7 per 1,000 of the population estimated to be living at those ages. In the seventy-seven large towns the death-rate in this age-group averaged 9.4 per 1,000, and ranged from 3.5 in King's Norton, 4.1 in Hornsey, 4.2 in Handsworth (Staffs), 5.8 in Ipswich, 6.2 in Leicester, and 6.3 in Bournemouth, to 12.2 in Oldham, 12.3 in Coventry and in Liverpool, 13.4 in Sheffield and 15.1 in Middlesbrough.

Among persons aged 65 years and upwards the rate of mortality last quarter was 104.6 per 1,000; in the seventy-seven towns the death-rate in this age-group averaged 111.9 per 1,000, the lowest rates being 69.0 in King's Norton, 76.5 in Handsworth (Staffs), 85.8 in West Bromwich and 87.0 in Norwich and in Devonport; and the highest rates, 140.0 in Swansea, 143.0 in Huddersfield, 144.2 in

Dewsbury, 155.4 in Burnley and 158.5 in Bootle.

The mean temperature of the air last quarter was above the average in most districts; the total amount of rainfall was less than the average; and, owing to the general dullness in March, there was a deficiency in the total duration of bright sunshine during the quarter.

APPROPRIATIONS FOR THE UNIVERSITY OF ILLINOIS

THE forty-seventh general assembly of the state of Illinois, which closed its regular session on June 1, by a record breaking act, has distinguished itself in the cause of state education. Former legislatures of the state had made what was considered at the time generous appropriations for the state university. The present General Assembly, however, recognized the ever-increasing needs of the state university and its great public service by appropriating for its support for the coming biennium the sum of $3,519,300. This is the largest appropriation ever made by a state legislature to a state educational institution and a million and a quarter larger than the largest appropriation ever before made to the University of Illinois.

But this is not all. The present general assembly not only recognized the immediate needs of the university and provided for them, but it had the courage to look ahead and make wise provision for the future by levying a one mill tax for its continued support. It is estimated that this tax will yield an income to the university, two years hence, of about two and one quarter million dollars a year. Thus the legislature has crowned its important work for state education by providing what is in effect a permanent annual grant equal to the income at 5 per cent. of an endowment fund of $45,000,000.

By these acts the general assembly eloquently expresses its confidence in the management of university affairs and its general approval of the able leadership and restless energy of the university's president, Dr. Edmund J. James.

The extent and nature of the work of the university for which the legislature has made appropriations will be seen from the following items:

		For the Biennium 1911–1913
For salaries and operating expenses ..		$1,150,000
Books for the library		50,000
Maintenance of the College of Engineering and Engineering Experiment Station (not including building) ..		180,000
For the College of Agriculture and Agricultural Experiment Station (not including buildings)		799,300
For Social and Political Science		50,000
Support of Law School		50,000
Support of Graduate School		100,000
Support of College of Medicine		120,000
Maintenance and equipment of Mining Engineering		55,000
Support of ceramics		30,000
For new buildings		724,000
Armory	$100,000	
Engineering building and ground	200,000	
Building for School of Commerce	125,000	
Addition to Woman's building	125,000	
For Kiln House for Ceramics	21,000	
For agricultural buildings	153,000	
For purchase of land, Agricultural Experiment Station		20,000
Other items not included above		191,000
Total		$3,519,300

In addition to the above the university will receive from the federal government and other sources funds that will bring its income to about $2,000,000 per annum for the next biennium beginning July 1, 1910.

Of the above appropriations there is one item that should be noticed particularly as it is the first appropriation ever made by the state of Illinois for the purpose specified. It is the item of $60,000 per year for the support of the College of Medicine of the university. By this act the state of Illinois takes its place among modern states in recognizing its high duty to take measures for the protection of the health of its citizens.

No account has been taken in the above items of the appropriations made for the State Laboratory of Natural History, for the State Entomologist's Office, for the State Geological Survey and the State Water Survey, whose activities are closely allied with the work of the university.

B. E. Powell

SCIENTIFIC NOTES AND NEWS

The University of Göttingen has conferred the honorary degree of doctor of philosophy upon Professor Albert A. Michelson, head of the department of physics at the University of Chicago, and retiring president of the American Association for the Advancement of Science.

The George Washington University has conferred the honorary degree of doctor of medicine on Dr. L. O. Howard, chief of the Bureau of Entomology and permanent secretary of the American Association for the Advancement of Science, for "distinguished services to science in relation to preventive medicine."

Cambridge University has conferred its doctorate of science on Dr. George E. Hale, director of the Solar Observatory of Mt. Wilson, and on Dr. T. W. Richards, of Harvard University.

Dr. Allen J. Smith, dean of the Medical School of the University of Pennsylvania, received the degree of LL.D. at the exercises attending the opening of the Medical School Building of McGill University.

Surgeon-General Charles F. Stokes, U. S. Navy, delivered the valedictory address at the commencement exercises of Jefferson Medical College, Philadelphia, on June 5. On this occasion the college conferred on him the degree of LL.D. and on the following day Columbia University, from which he graduated in medicine, gave him the degree of D.Sc.

Under the auspices of the president and council of the Chemical Society, the Faraday lecture was delivered in London on June 14 by Professor Theodore W. Richards, of Harvard University. At the conclusion of the lecture the Faraday medal was presented to Professor Richards.

Dr. W. M. Davis, Sturgis-Hooper professor of geology at Harvard University, has been appointed visiting professor at Paris under the new arrangement between Harvard and the Ministry of Public Instruction.

At the annual meeting of the London Institution of Electrical Engineers, Mr. S. Z. de Ferranti was elected president.

Professor Pohl, of Prague, has been appointed director of the institute of pharmacology at Breslau in place of Professor Filehne.

There have retired from active service Dr. Rudolf Nietzki, professor of chemistry at Bâsle; Dr. Louis Isely, professor of mathematics at Neuchâtel, and Dr. Bernhard Tollens, associate professor of agricultural chemistry at Göttingen.

Professor Chas. W. Hargitt, of Syracuse University, has recently returned from a seven-months' sojourn in Europe as a part of his sabbatic year. After brief visits to the laboratories at Plymouth, London University, Munich, Vienna and Paris, four months were spent at the Naples Zoological Station, occupying the Smithsonian table. Several American laboratories have also been visited.

Professor Burton E. Livingston, of the Johns Hopkins University, will continue his researches at the Desert Laboratory, Tucson, Ariz., during the present summer. He will be assisted by Professor J. S. Caldwell, of the University of Nashville.

Mr. Frederick G. Clapp has been investigating the geological occurrence of petroleum in the Mexican oil fields.

The first two incumbents of the Kahn traveling fellowships for American teachers are Professor John H. T. McPherson, professor of history and political science in the University of Georgia, Athens, Ga., and Professor Francis Daniels, professor of romance languages in Wabash College, Crawfordsville, Ind.

On May 29 Professor Herbert N. McCoy, of the University of Chicago, delivered the

annual lecture before the Northwestern Chapter of Sigma Xi on the subject "Radioactivity and the Nature of Matter."

ACCORDING to *Nature* a festival in memory of Richard Jefferies was held at Swindon on Saturday, June 10. Jefferies was born at Coate, near Swindon, and spent his early life in the latter place. A visit to Coate Farm, the naturalist's birthplace, and an open-air concert, morris dancing, speeches and a short service in Chiseldon Church were arranged.

DR. EMMA WILSON DAVIDSON MOOERS, custodian of the neuropathological collection of the Harvard Medical School, whose death we announced last week, died of streptococcus septicemia and meningitis. The infection was contracted by contact with a brain from a subject dying in the recent tonsilitis epidemic of Cambridge, Mass. Dr. Southard, who removed the brain at autopsy, escaped with merely a septic hand.

ISAIAH FAWKES EVERHART, M.D., naturalist and philanthropist, died at Scranton, Pa., on May 26, 1911, aged 71 years. Dr. Everhart was the founder and endower of the Everhart Museum of Natural History, Science and Art. A bronze statue of Dr. Everhart, presented by Dr. B. H. Warren, of West Chester, has been erected in front of the museum at Scranton, and preparations were being made for its unveiling.

DR. CARL BECK, president and surgeon of St. Mark's Hospital and professor of surgery in the New York Post-graduate Medical School, has died at the age of fifty-four years.

DR. ALEXANDER BRUCE, known for his contributions to neurology and diseases of the nervous system, has died at the age of fifty-six years.

DR. LUDWIG KERSCHNER, professor of histology and embryology at Innsbruck, has died at the age of fifty-two years.

THE U. S. Civil Service Commission announces the postponement to July 5, of the examination announced to be held on May 24, to fill the position of soil bibliographer, Bureau of Soils, Department of Agriculture, at a salary of $1,400 per annum.

BARON ALBERT VON ROTHSCHILD, of Vienna, has bequeathed $40,000 to establish a prize in astronomy.

Nature states that the sum of £1,000 has been placed at the disposal of the British home secretary by a colliery proprietor to form a prize for the best and safest electric lamp for use in mines, and Messrs. C. Rhodes and C. H. Merz have consented to act as judges upon the lamps submitted. The competing lamps must be addressed: care of Mr. C. Rhodes at the Home Office Testing Station, Rotherham, and must be delivered by December 31 next.

THE *Journal* of the American Medical Association states that the scientific laboratories on Monte Rosa, named after the late Professor A. Mosso, of Turin, will be opened for scientific research on and after July 15. There are sections devoted to physiology, botany, physics and microbacteriology, and there are nineteen posts open to research workers from the countries or institutions which contribute to the support of the institution. Applications for reservation of a place must be sent to the director, Dr. A. Aggazzotti, Corso Raffaello 50, Turin, Italy, not later than July 1, with specifications as to the subject of research and the credentials from the government or institution.

THE old mounting of the 18½ inch equatorial of the Dearborn Observatory, which has done service for nearly half a century, has just been replaced by an entirely new mounting from the firm of Warner & Swasey. Observations with the new instrument were begun on June 1.

Nature states that the British Museum has acquired, at an almost nominal price, the valuable collection of specimens illustrating the religion of Polynesia, which was long in the possession of the London Mission Society. Many of the specimens are unique, and it would now be quite impossible to form such a collection. Among the most remarkable objects are the great tapering idol of the national god of Raratonga, kept swathed in

blue and white matting; Tangaroa, the supreme god of Polynesia, a wooden figure with small human-like objects sprouting from his eyes, mouth and other parts of his body, typifying his creative power; and a head-dress of black feathers, which completes a mourning costume already owned by the museum.

UNIVERSITY AND EDUCATIONAL NEWS

Swarthmore College has succeeded in its undertaking of raising a half million dollar endowment fund. In addition the heirs of the late Phoebe Anna Thorne, of New York, have given the sum of $200,000 to the college, making a total of $700,000 additional endowment. These increased resources will not be used to enlarge the college, but to strengthen it, to improve its present equipment, and to aid it in carrying on its work as a small college.

The gift of $100,000 in lands by James B. and Benjamin N. Duke, of $50,000 for a new building by James B. Duke, and of $10,000 by B. N. Duke for campus improvements, was announced at the commencement exercises of Trinity College, Durham, N. C.

A gift of $20,000 to aid general research in the study of diseases, at the Yale Medical School, has been announced from Francis E. Loomis, of the class of 1864. Further gifts of $10,000, toward the endowment of the university clinic, and to the Peruvian exploration fund, for the Yale expedition under Assistant Professor Hiram Bingham, have also been announced. For the exploration fund a total of about $12,000 has been pledged.

Mr. James R. Steers, '53, has made a further contribution to the Wolcott Gibbs library of chemistry at the College of the City of New York. He has endowed it with $5,000 in five per cent. bonds, the income to be used for upkeep.

McGill University has received from Lady Graham, honorary treasurer of the Dr. A. A. Browne memorial fund, the sum of $10,000, which is to be devoted to the establishment of a fellowship for the advancement of medical science.

We learn from *Nature* that the Mathematical Society and the Society of Applied Physics of Göttingen have given 100,000 Marks to a fund for the creation of an institute of mathematics in connection with the University of Göttingen. Two donations of 50,000 Marks from manufacturing houses have also been received.

It is announced that a considerable addition to the laboratory of plant physiology of the Johns Hopkins University will be erected during the present summer. This will include both laboratory and greenhouse space, adapted to advanced work and research.

An Imperial University Congress will be held at the University of London in the summer of 1912.

A new plan of studies at the Harvard Dental School will go into effect October next. During the first half year the students will divide their time between chemistry and general anatomy, including dissection of the cat, embryology, organology and histology. During the second half year they will have human dissection including special work in the anatomy of the head, and they will also have at the same time physiology. The courses have been entirely recast, but the concentration system of studies has been preserved. The new plan has been adopted in the hope of gain from the logical sequence of the subjects.

Only the men of the college of letters and science, the school of medicine and the commerce courses will be expected to wear caps and gowns at the commencement exercises of the University of Wisconsin. Owing to the sentiment among the agricultural, law and engineering students they will not be asked to wear the cap and gown.

At the University of Michigan assistant professor R. H. Curtiss, of the department of astronomy, has been made junior professor and assistant director of the observatory to take the place of Professor W. J. Hussey, during the latter's absence at La Plata University. Assistant professor S. J. Zowski, of the engineering department, has been made junior professor of mechanical engineering and Junior Professor Alfred Holmes White, of the same department, full professor of

chemical engineering. Dr. C. H. Kauffman, instructor, has been made assistant professor of botany. Aubrey Tealdi, instructor, has been made assistant professor of landscape gardening, and Dr. G. L. Jackson, instructor, has been made assistant professor of education. Dr. A. G. Ruthven, curator of the museum, has been made assistant professor of zoology.

DR. J. G. FITZGERALD has been appointed associate professor of bacteriology in the University of California.

WILLIAM H. WELKER, Ph.D., has been appointed assistant professor of biological chemistry in Columbia University.

M. TISSOT, an assistant in the Paris Museum of Natural History, has been appointed professor of physiology in the museum.

DR. WENZELL LASKA, of the Technical School at Lemberg, has been appointed professor of mathematics in the Bohemian University of Prague.

DR. ERHARD SCHMIDT, of Erlangen, has been called to the chair of mathematics at Breslau.

DISCUSSION AND CORRESPONDENCE

THE APPOINTMENT, PROMOTION AND REMOVAL OF OFFICERS OF INSTRUCTION

IN a recent paper under the above title[1] Mr. Sidney Gunn makes the following references to Brown University.

> Another illustration of the way the public takes removals can be found in the case of Brown University. . . . Repeated complaints have been raised of men having been cajoled, crowded or thrust out of the Brown faculty with varying degrees of suddenness and consideration. In some cases the men so treated have served the university for many years without being found incompetent or even unworthy of regular promotion—something which in most institutions is regarded as establishing a claim that prevents removal on the ground of natural unfitness.

The paragraph quoted was to be sure part of the material of an argument against the contention of President Van Hise that public sentiment would always visit speedy condemnation upon a college president or corporation if the power of removal were unfairly or unjustly used. I am not inclined to disagree with this main thesis of Mr. Gunn's paper, nor do I care to enter upon a discussion of the causes or conditions of removal of members of the faculty of Brown University in recent years. Such discussion could serve no good purpose, and would only lead to futile controversy. I do, however, deeply regret that a reference to Brown University should appear in SCIENCE from which every reader must inevitably draw the inference that the situation at Brown is typically bad with respect to the academic freedom and the tenure of office of its teachers; that the members of the Brown faculty do not enjoy a reasonable security of tenure but are liable, even after long and apparently satisfactory service, to be removed arbitrarily by the president or governing board.

That its administrative body has never made an error of judgment is more than can be said, probably, of any long-established institution; but all friends of collegiate education Mr. Gunn included, should be glad to know that the indictment contained in the statements and implications of Mr. Gunn's paragraph referring to Brown is not justified by the policy of the university.

The permanency of tenure of office for professors is secured by the ancient charter of the university. A professor can be removed only "for misdemeanor, incapacity or unfaithfulness." The president and governing boards at the present time also recognize the fact that security of tenure, in the long run, is to the university a financial asset as well as a necessary condition of continuous and contented scholarly work and the natural and appropriate reward of loyalty and of long and faithful service. It is the well understood policy of the university to construe the principle of tenure, in accordance with the spirit of the charter, as applying to those assistant and associate professors who have served many years satisfactorily.

Instructorships are considered to be tempo-

[1] SCIENCE, May 12, 1911, p. 729.

rary appointments even after the salary is increased; and the promotion from an instructorship to an assistant professorship, while it carries with it encouragement and expectation of later permanence, does not immediately commit the university to a guarantee of permanent tenure. This is reasonable, for, if the instructor for any reason does not fit the particular position, after a trial of a few years, no one interested in the welfare either of the university or of the instructor himself would desire that he be promoted to a professorial position. Similarly if, after a few years, the assistant professor fails to fulfil the expectations which accompanied his promotion or appointment or if he apparently has reached the limit of his growth in the environment of the particular institution, no one can fairly object to his being advised, or urged if necessary, to seek elsewhere to establish his permanent professional position, provided, of course, that he is given ample time and friendly assistance to make the change.

At Brown, those teachers, whether professors, associate professors or assistant professors who, as distinguished from these younger men, have served the university many years and have been encouraged to believe or allowed to suppose that their services have been satisfactory until the time is past for a reasonably fair chance of readjustment in other positions, are insured by the university's policy of tenure against being "cajoled, crowded or thrust out of the Brown faculty." Contrary to the inference which would naturally be drawn from Mr. Gunn's paragraph, such service at Brown University "is regarded as establishing a claim that prevents removal on the ground of natural unfitness." The administration recognizes its responsibility in case it fails to diagnose natural unfitness in the course of the years of probational service.

In view of this recognized policy there is in the university a feeling of security of tenure and there is also an academic freedom of opinion, utterance and action which is ideal and is highly valued and appreciated by the faculty.

A. D. Mead
Brown University

Correspondence with the International Commission on Zoological Nomenclature

The secretary of the International Commission on Zoological Nomenclature feels constrained to invite the attention of the members of the zoological profession to an important point in connection with the subject of correspondence.

The commission is composed of fifteen members, elected by the International Congress of Zoology. The duties involve a considerable amount of tedious labor. All of the members give their time willingly to this work from a pure sense of duty to science and to their profession. They do not ask nor do they receive one cent of remuneration for the many hours of time and work they sacrifice in order to endeavor to carry out the duties imposed upon them.

At the urgent request of colleagues, additional labors have been undertaken that were not contemplated when the commission was originally formed in 1895.

With the increase of duties, the correspondence has naturally grown to not inconsiderable proportions, and this additional correspondence brings with it increased labor and increased sacrifice of time.

It is a pleasure to acknowledge the fact that many of the members of the profession seek to aid the commission by valuable suggestions and it seems needless to state that this friendly cooperation is heartily welcomed and appreciated.

Some zoologists, however, appear to overlook the history, duties and purposes of the commission, and appear to assume that one of its objects and duties is to receive and read communications couched in language which is hardly within the bounds of diplomatic usage.

As the executive officer of the commission, and assuming full personal responsibility for this action, taken without consulting the other members, the secretary desires to give public notice that he insists that the same

courtesies be extended to the commission which it is customary to extend to other judicial bodies and other international committees. Suggestions, advice and objective arguments are welcomed, but polemics of all kinds will be consigned, unconsidered and unanswered, to the waste paper basket.

This public notice is given only after receipt of a number of letters couched in terms which it is exceedingly difficult to construe as within the bounds of professional courtesy or diplomatic usage.

CH. WARDELL STILES,
Secretary

THE ZOOLOGICAL RECORD

The Zoological Record, published annually by the Zoological Society of London, is now also the zoological volume of the International Catalogue of Scientific Literature, and is prepared with the active cooperation of the United States government, through the Smithsonian Institution. In spite of this, when the volume for 1909 came to hand recently, I was called upon to pay $2.50 duty, a larger sum than ever before. I thereupon applied to the Smithsonian Institution, and was informed that the *Record* appeared to be entitled to free entry, according to item 517 on page 71 of the Aldrich-Payne Tariff Bill of 1909. Armed with this information, I took up the matter with the U. S. Treasury, and after a lengthy correspondence with the authorities in Washington, New York and St. Louis, have received a check for the amount paid. I publish these facts for the information of other subscribers. It should be added, that not only is the *Record* entitled to free entry, but all "books and publications issued for their subscribers or exchanges by scientific and literary associations or academies."

T. D. A. COCKERELL

PRIMITIVE COPPER HARDENING

TO THE EDITOR OF SCIENCE: In his notably sane address on "The Lost Arts of Chemistry,"[1] Dr. W. D. Richardson refers to the question, much mooted among archeologists, concerning the hardening of copper in primitive art. While his general conclusion seems just, it is nevertheless liable to be questioned by collectors of primitive artifacts in this country and perhaps elsewhere. Some personal investigation of primitive copper artifacts indicates that for two reasons these are sometimes harder than is ordinarily attained by modern artisans. (1) While ordinary copper artifacts exhumed from mounds and other burial places are commonly coated with the green oxide, the edges of knives and sometimes other portions are patinated; and usually the patina (which may extend on both sides of the blade quite to its edge) is decidedly harder, albeit more brittle, than the unchanged copper. Not infrequently this patina is mistaken for the normal condition of the metal; and the collector regards his artifact as an evidence of artificial hardening beyond the reach of modern artisans. (2) Judging both from the condition of the prehistoric artifacts and from the methods pursued by primitive artisans, the copper implements of the American aborigines were commonly hardened by hammering, albeit rather adventitiously than intentionally. Now, in the process of working, the tools employed (corresponding to hammer and anvil) were not of steel or other resilient metal, but of stone; and experiment indicates that under the blows of an inelastic stone hammer on a thin blade resting on an inelastic stone anvil, the successive impacts are not so well distributed throughout the mass of the metal as are those produced by resilient steel tools; so that the blade undergoes a sort of skin-hardening, naturally culminating in the cutting edge. Of course this effect might easily be imitated by a modern artisan using primitive tools; yet it is a factor to be reckoned with in considering the widespread belief in the superior hardness of primitive copper artifacts. Speaking broadly, the notion of lost arts, which Dr. Richardson effectively combats, is a mischievous one. Of course throughout the long, devious and vacillating course of human progress, arts have disappeared—usually because replaced by superior arts. The indus-

[1] SCIENCE, Vol. XXXIII., 1911, p. 513 et seq.

trial arts especially rank among the most permanent, not to say eternal, of all the manifestations of humanity. It is hardly too much to say that only by the extinction of entire peoples are useful arts ever lost (except as superseded by more useful devices); and until well within the period of writing any arts possibly lost by extinction of peoples left little trace.

W J McGee

SCIENTIFIC BOOKS

Light and the Behavior of Organisms. By S. O. Mast. New York, John Wiley and Sons. 1911.

While the present volume deals primarily with the question of the orientation of organisms the author tells us that it "may be considered a treatise on the behavior of organisms in their reactions to light." The first three chapters constituting Part I. are devoted to the historical setting of the subject and the statement of general problems and view-points. Part II. is concerned with the way in which organisms turn towards or from a source of stimulation. In addition to giving a very good résumé of the observations of others upon orientation this part contains a considerable amount of new material from the author's own researches. These include investigations of orientation in Indian corn, *Nasturtium, Amœba, Euglena* and a few other flagellates, the swarm spores of *Œdogonium, Hydra, Eudendrium* and some worms and insect larvæ. In general this work gives evidence of having been done with care and accuracy and adds materially to our knowledge of the general *modus operandi* of orientation. It is evident now to every one who has followed the work in this subject during the past few years that orientation is accomplished by a great variety of methods in different organisms. There is no such thing as a general scheme of orientation.

Loeb's theory of orientation is the author's favorite object of attack and he recurs to this doctrine and certain other views of Loeb with the persistence of Cato in urging the destruction of Carthage. It is not difficult to adduce cases that do not fall under Loeb's explanation of the way in which animals become oriented, but some of Mast's own investigations seem to afford about as good support as has been furnished for the theory which he so persistently attacks. No clearer case of orientation through the local response of the part directly stimulated could well be imagined than the one afforded by *Amœba,* and the author admits that the "method of orientation is in harmony with much in Verworn's theory and also with the essentials in Loeb's." But he adds that "it does not, however, support the idea connected with these theories, that a constant intensity produces a constant directive stimulation." I am not sure that I understand the pertinency of the criticism, for there is nothing in the theories of either of these writers which implies that the actual stimulating effect of any directive agency is subject to no variation. Both of these writers have adduced several cases which show that such variation occurs, and it is out of the question to suppose that either of them has overlooked the obvious importance of internal changes in determining the way in which an animal responds.

The author's experiments on the larvæ of *Arenicola* are of especial interest in regard to the problem of orientation. There is no reference either in the text or in the bibliography to the previous work of Lillie on the method of orientation in this form, although there is a quotation from a paper by Lillie dealing with certain features of its structure and development. The observations of Lillie are in general confirmed, but Mast has performed several additional experiments which bring out more clearly the fact that orientation is "due to difference of intensity on opposite sides" of the organism. The orienting response is shown to be due to light falling upon the eyes, the other parts of the body being apparently insensitive to this stimulus. When the larva is suddenly illuminated on one side there are no random or trial movements, but the head is bent directly toward the source of light. All the evidence points to the conclusion that orientation is the result of comparatively

simple reflex responses. The question remains open whether the stimulus is produced by the direct action of light on the sensitive surface of the animal or by changes in intensity of the stimulus caused by the lateral movements of the body. The question in this as in many other cases is difficult to decide. Analogy with the method of orientation in *Euglena* leads the author to incline toward the latter alternative, but the experimental data obtained did not enable him to solve the problem. In either case orientation in this form is apparently as automatically regulated an activity as one might expect according to the well-known theory of Loeb.

The problem of whether the rays of light *per se* or variations of light intensity *per se* afford the stimuli which cause orientation is discussed in connection with accounts of experiments on the blow fly, earth-worms and other forms. There is much to be said for the efficiency of both these factors in special cases. There are instances in which the shock of transition from one light intensity to another causes a marked reaction. Light in other cases has a constant stimulating effect apart from any shock of transition. In an organism going towards or away from the light deviations from the direct course produce a change of intensity of light falling on its two sides; that the animal turns directly and automatically into line does not of itself enable one to decide whether it turns because it is more strongly stimulated on the one side than on the other, or whether it turns on account of a change of light intensity. There have been few attacks upon this particular problem and the author does well to bring it into more prominence than it has usually been accorded.

Part III., entitled General Considerations on Reactions to Light, deals chiefly with the various methods of forming groups in regions of certain optimum illumination, reactions which involve no directive effect of light, and the factors which induce changes in the phototactic response. There is no discussion of any theoretical attempt to explain the reversal of phototaxis and the author advances no views of his own.

Part IV. deals with reactions to light of different wave-lengths. Much work in this field has given inconclusive results on account of failures to obtain pure monochromatic light and on account of not taking into consideration differences in energy of different wave-lengths. While in general the rays toward the violet end of the spectrum are more potent in producing the heliotropic response in both plants and animals, the rule is not without exceptions in both kingdoms. As the writer states, this is probably due to the fact that some chemical processes are accelerated by light of certain wave-length, while other chemical processes are accelerated most by light of a different wave-length. Sometimes monochromatic light is more potent than white light, a fact which suggests that certain rays tend to inhibit or reverse chemical reactions which are caused by rays of a different wave-length. Mast's treatment of the effect of light of different wave-lengths can not fail to be very helpful to all workers in this rather difficult subject.

The final chapter on Theoretical Considerations contains, besides a general summary of results, a renewed attack upon Loeb, a short consideration of the much-refuted vitalism of Driesch, and an exposition of the general position of Jennings to which the author is a very close adherent. After stating that according to Jennings's views the reactions of an organism are fundamentally purposeful and that they depend upon previous activity as well as present external conditions, the author expounds the position of Jennings as follows: "Reactions are defined as changes in the activity of organisms. Such changes may occur under constant external conditions. They are therefore due primarily to internal changes. External factors cause reactions not directly, but indirectly, by altering internal processes (physiological states). Variability in reaction to given external conditions is due to changes in physiological states. If an organism responds to light of a given intensity in a given way now, and to the same intensity in another way later, it is because the physiological state of the organism has changed." Fol-

lowing this with a statement of the principle of association, Mast continues:

> Every step in the development of the theory is supported by numerous experimental facts and all seems to fit with what is known concerning the reactions of organisms. Reactions, according to the theory, are as stated above, primarily due to physiological states. External agents ordinarily produce reactions through the effect they have on these states. By the application of this idea all the different phenomena connected with reactions to light as summarized at the beginning of this chapter can be accounted for.

All this sounds rather naïve as compared with the critical exposition of the preceding part of the volume. It would indeed be comforting to be able to repose with such a spirit of confidence and contentment in a general philosophy of behavior, but it is perhaps pertinent to enquire if the author has not been deceived with the delusive appearance of explanation where no real explanation has been given. It is an obvious truism that external factors cause reactions by altering internal processes; else they would not be reactions at all. It is equally obvious that if changes of behavior occur where external conditions do not vary they must be due to the fact that internal conditions do vary; or, in other words, if the cause of a change is not outside of the organism it must perforce be inside of the organism. Phenomena may thus be "accounted for" on the basis of varying internal states, but as it is admitted that in most cases we are entirely ignorant of what these states are we are about as much enlightened as we are by the celebrated explanation of the sleep-producing effect of opium by attributing it to a dormitive principle.

There is a useful bibliography in which the effort is made to include all the important works on reactions to light in both animals and plants, but several noteworthy contributions are not included. Notwithstanding minor defects, the work of Mast will prove of great value to students of the effect of light on the behavior of organisms, and the author is to be congratulated on having made so substantial a contribution to the subject.

S. J. Holmes

A Laboratory Manual of Physical Geography. By R. S. Tarr and O. D. von Engeln. New York, The Macmillan Company. 1910.

Tarr and von Engeln's "Laboratory Manual of Physical Geography" is the most practical and best organized manual that has yet appeared. Prepared as an exercise and note-book, with detachable leaves, and containing within its covers a large part of the necessary equipment for work, except for topographic maps, minerals and certain simple pieces of physical apparatus, it is a hand-book and guide available for both the expert and inexpert teacher. Although primarily devoted to the study of physical geography, much emphasis is made of life relations and therefore the book not only meets a present condition, but makes possible a development of the phase of geography which is beginning to be emphasized by the better secondary school teachers.

Of the seventy-three exercises in the book, nine are devoted to the earth as a globe, seven to excursions, eight to minerals and rocks, five to map study, twenty-six to the physiography of the lands, two to the ocean, fourteen to the atmosphere and one each to life zones and magnetism.

Thus the special emphasis is good, though it is questionable whether mineral and rock study deserves to remain in physical geography and whether the ocean is not given too little emphasis. The larger life relations to the ocean, apart from the phenomena associated with ocean currents and tides, are so important and fascinating that it seems unreasonable to omit them, while space is given to minerals and to the physical phenomena of condensation. Laboratory work should be devoted to topics that are not capable of being learned more easily and more effectively through demonstration, and certainly condensation can not be included in this class.

The order of treatment under the land forms is original in that types of plains are studied in relation to drainage and not following drainage, and thus a better unity is preserved. Mountains are grouped according to

origin and presented in a similar all-round way. The later exercises under this head are listed according to their distribution in the United States and not primarily according to the class to which they belong.

Taken as a whole, however, the volume has few elements of weakness and many of strength. It has been tested in practise with beginning pupils and hence is not too advanced or specialized. It is a most valuable contribution to educational geography and ought to help strengthen and humanize physical geography teaching in our high schools, and it should be remembered that for many years such work has been unhuman, if not at times almost inhuman.

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The Principles of Electro-deposition. A laboratory guide to electro-plating. By SAMUEL FIELD, A.R.C.Sc. (Lond.), F.C.S. New York, Longmans, Green & Co. 1911, 12mo. Pp. xv + 383.

This is one of those manuals designed for the purpose of interesting further the purely technical worker, so that he may be led to learn something at least of the principles upon which the operations he observes daily are based.

After considering the apparatus for the production, regulation, and measurement of the electric current; plating with copper, nickel, iron, tin, zinc, silver, gold and brass are taken up in detail, from the theoretical as well as the practical viewpoint, the methods of preparing the object for plating, as well as the finishing, after that process is complete, also being considered. This is followed by several chapters on the methods for the qualitative and quantitative analysis of the substances employed in the various processes.

Whether the worker will actually gain the knowledge which the author hopes he may is a question, for much depends upon the elementary knowledge which can be assumed to be in the possession of the reader. One thing is quite certain, however,—the readers, or at least some of them, will find their interest greatly aroused by a perusal of this book, even though it may not be thoroughly understood; with the result that they may be led to seek some school where a thorough training in the subject may be acquired. Books of this type are of the greatest value, for it is to them that we must look for the first step in that great advance in industrial work—the perfect combination of theory and practise.

J. L. R. M.

SCIENTIFIC JOURNALS AND ARTICLES

ANNOUNCEMENT is made of the establishment of *The Journal of the Washington Academy of Sciences.* It is to be a semi-monthly publication and will be sent to subscribers on the first and fifteenth of each month, or during the summer may appear on the fifteenth only, as double numbers. The first number will be issued about July 15, but after 1911 the volumes will correspond to the calendar year. The present *Proceedings of the Washington Academy of Sciences* will be discontinued after the completion of the current volume. The *Journal* will be a medium for the publication of original papers and a record of scientific work in Washington. It will accept for publication (1) brief papers written or communicated by resident or non-resident members of the academy; (2) abstracts of current scientific literature published in or emanating from Washington; (3) proceedings and programs of the affiliated societies, and (4) notes of events connected with the scientific life of Washington. The editors are: George K. Burgess, Bureau of Standards; Barton W. Evermann, Bureau of Fisheries, and Frederick Leslie Ransome, Geological Survey. Illustrations will be used only when necessary, and will be confined to text figures or diagrams of simple character. The editors, at their discretion may call upon an author to defray the cost of his illustrations, although no charge will be made for printing from a suitable cut supplied with the copy.

THE contents of the *Astrophysical Journal* for June are as follows:

"On Doppler's Principle in Connection with the Study of the Radial Velocities on the Sun," A. Cotton.

"On the Magnetic Separation of the Spectral Lines of Calcium and Strontium," B. E. Moore.

"On the Radiation of the Companion of Algol," Joel Stebbins.

"On Regularities in the Spectrum of Neon," Herbert Edmeston Watson.

"Application of the Interference Method to the Study of Nebulæ," Ch. Fabry and H. Buisson.

"Observations of Nova Lacertæ at the Yerkes Observatory," Edwin B. Frost.

"Photographic Determinations of Stellar Parallax made with the Yerkes Refractor." VI., Frank Schlesinger.

The June issue of the *Journal of Comparative Neurology* contains the following articles:

"The Evolution of the Sympathetic Nervous System in Vertebrates," Albert Kuntz.

"The Olfactory Nerve and the Nervous Terminalis of Ameiurus," Charles Brookover and Theron S. Jackson.

"The Nervus Terminalis in Urodele Amphibia," Paul S. McKibben.

"Localization of the Motor Area in the Sheep's Brain by the Histological Method," Jessie L. King.

PRE-COLUMBIAN REFERENCES TO MAIZE IN PERSIAN LITERATURE

That maize is of American origin is no longer a disputed question, but the discussion of the possibility of its having been known in Europe and in the east before the discovery of America by Columbus is by no means closed.

There was much written on this subject in the first quarter of the nineteenth century, and one of the historical references to which much importance was attached is an alleged mention of *rous* by Mirkhond, a Persian historian of the fifteenth century (1433–1498). The authority for the existence of such mention by Mirkhond is Herbelot, an orientalist of note, who uses the word *rous* as synonymous with *blé de Turquie,* which was a name for maize in common use at the time.[1]

Under the word Rous, in the "Bibliothèque orientale," Herbelot says (italics ours): "Rous. Name of the eighth son of Japhet, son of Noah, from whom Russia, which we now call Muscovy, has taken its name. Mirkhond wrote in the genealogy which he has given us of the Mogols, ancestors of Jenghiz Khan, that Rous was of a very different disposition from his brother Khozar . . . so that Khozar was obliged, in order to live in peace with his brother to yield to him all the islands of this great river (Volga) which empties into the Sea of Khozar which we call Caspian. Rous sowed in all these islands the wheat which we call *de Turquie* and which the Turks still call, to-day, in their language, by the name of *rous* and boulgar."[2]

Bonafous, in his monumental work on maize quotes the above and says (italics ours): "The celebrated orientalist, Herbelot, refers to a passage from Mirkhond, a Persian historian of the fifteenth century of which the translation, *if it is exact, would leave no doubt that maize was known in the Old World before the discovery of the New.*"[3] Bonafous proceeds to say, however, that after an examination of the text of Mirkhond, at the place

[1] Harshberger, "Maize: A Botanical and Economic Study," University of Pennsylvania, Contributions from the Botanical Laboratory, Vol. 1, p. 89; Browne, "Maize or Indian Corn," American Institute, Annual Report, Vol. 5, 1847, p. 412.

[2] "Rous. Nom du huitième fils de Japhet, fils de Noé, duquel la Russie, que nous appellons aujourd'hui Moscovie, a pris son nom. Mirkhond écrit, dans la généalogie qu'il nous a donnée des Mogols, ancêtres de Ginghizkhan, que Rous étoit d'une humeur bien opposée à celle de son frère Khozar, . . . en sorte que Khozar fut obligé, pour vivre en paix avec son frère, de lui céder toutes les isles de ce grand fleuve qui se décharge dans la mer de Khozar, que nous appellons Caspienne. Rous fit semer dans toutes ces isles *le bled* que nous appellons *de Turquie,* et que les Turcs appellent encore aujourd'huy en leur langue du nom de *rous* & boulgar." (Herbelot, "Bibliothèque orientale," 1777–78, Vol. 3, p. 137.)

[3] "Le célèbre orientaliste d'Herbelot rapporte un passage de Mirkhond, historien persan du quinzième siècle, dont la version, *si elle est exacte, ne laisserait pas douter que le maïs n'était connu dans l'Ancien-monde avant la découverte du Nouveau.*" (Bonafous, "Histoire naturelle du Maïs," 1836, p. 22.)

indicated by Herbelot, he finds nothing to justify the latter's statement in regard to *rous,* and adds, as he dismisses the subject, "Either this author must have drawn from some other source than that which he indicates, or a strange confusion must have prevailed among the notes which he had collected."[4]

This judgment of Bonafous' seems for the time to have closed the question, but the investigation of the subject of the origin of maize in connection with some bibliographical work being done in the Bureau of Plant Industry, of the United States Department of Agriculture, has revealed the fact that several scholars of note agree that Herbelot and others often ascribed to Mirkhond statements which were really taken from the writings of Khondemir[5] (1475–1534).[6]

Khondemir wrote at almost the same time as Mirkhond, although he was his grandson,[7] and his best known work, the Khelassé-al-âkhbar, is very nearly identical in subject matter with Mirkhond's History of the world, the Rauzet-al-safa. Reinaud says: "The Khelassé-al-âkhbar . . . which, however, is for the most part only an abridgment of the Rauzet-al-safa, composed by Mirkhond, has furnished Herbelot with a large part of his historic articles."[8]

The similarity of subject matter in the two works is shown by a comparison of the summaries of the two parts in which we are especially interested—part 9, of the Khelassé-al-âkhbar, and part 5, of the Rauzet-al-safa. Of the former Reinaud says, "The author goes back to Japhet. He undertakes to relate everything worthy of note that has happened in the northern countries of Asia, and then gives many details of the wars of Jenghiz Khan and of his descendants."[9] Of part 5, of Mirkhond's Rauzet-al-safa, Jourdain says: "Introduction to the history of Jenghiz Khan, in which Mirkhond traces that of some Tartar and Mogol princes from Japhet, son of Noah, to this victorious Mogol."[10]

Having thus seen, first, that the two authors, Mirkhond and Khondemir, were often confused, and second, as a reason for the confusion, that the subject matter of the Khelassé-al-âkhbar of Khondemir and the Rauzet-al-safa of Mirkhond is, for the most part, the same, it seems reasonable to advance the conjecture that Herbelot drew his information from Khondemir rather than from Mirkhond, and that this probable error in crediting the quotation accounts for the failure of Bonafous to verify the reference.

The statement concerning maize ascribed to Mirkhond loses none of its value in the investigation of the early history of maize, if taken from the writings of Khondemir, so that an examination of his writings, especially part 9, of the Khelassé-al-âkhbar, becomes important. A copy of this work is in the

[4] "'Ou cet auteur aura puisé à une autre source que celle qu'il indique, ou une étrange confusion se sera mise dans les notes qu'il avait rassemblées'' (*loc. cit.*).

[5] Variously spelled, Khondemir, Khwand amir, Chuandamir.

[6] Silvestre de Sacy, "Mémoires sur diverses antiquités de la Perse," p. xiii; Langlès, in "Notices et extraits des manuscrits de la Bibliothèque nationale," Vol. 5, 1799, p. 193; Audiffret, in Michaud, "Biographie universelle," Vol. 29, 1821, p. 133.

[7] Khondemir is often spoken of as the son of Mirkhond, but he himself says that Mirkhond was his maternal grandfather. (Rieu, "Catalogue of the Persian Mss. in the British Museum," 1879, Vol. 1, p. 96.)

[8] "'Le Khelassé-al-âkhbar . . . qui, du reste, n'est le plus souvent qu'un abrégé du Rauzet-al-safa, composé par Mirkhond, a fourni à d'Herbelot une grande partie de ses articles historiques.'' (Reinaud, in Michaud, "Biographie universelle," Vol. 22, 1818, p. 378.)

[9] "'L'auteur remonte jusqu'à Japhet. Il s'attache à relever tout ce qui s'est passé de remarquable dans les contrées septentrionales de l'Asie, et fournit ensuite beaucoup de détails sur les guerres de Djenguyz-khan et de ses descendants.'' (Reinaud, in Michaud, "Biographie universelle," Vol. 22, 1818, p. 379.)

[10] "'Introduction à l'histoire de Djenghiz-khan, dans laquelle Mirkhond trace celle de quelques princes Tartares et Mogols, depuis Japhet, fils de Noé, jusqu'à ce conquérant Mogol.'' (Jourdain, in "Notices et extraits des manuscrits de la Bibliothèque nationale," Vol. 9, 1813, p. 135.)

Library of the British Museum,[11] but we do not know of a copy in this country. We shall be glad to be informed if there is a copy in an American library.

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TERRESTRIAL MAGNETISM

The results of magnetic observations made by the Coast and Geodetic Survey between July 1, 1909, and June 30, 1910, have recently been printed at the Government Printing Office in Washington. The report is edited by R. L. Faris, Inspector of Magnetic Work; assistant, Coast and Geodetic Survey. The report includes the values of the three magnetic elements as measured during the fiscal year, at two hundred and thirty-two stations on land distributed through thirty-nine states and territories. Several other land stations were occupied and partial results are given for these. Of this number, seventy-five were "repeat" stations, nearly one third of the whole number. "The resulting values of annual change show that, as compared with 1905, west declination is increasing more rapidly in New England and the Middle States and east declination is increasing more rapidly in the western part of the country. The position of the line of no change is apparently about the same as in 1905." The year 1905 is doubtless referred to because to that year the last and most complete declination charts yet printed for the entire country were uniformly reduced. The results of a considerable number of observations at sea are given in this report. In connection with the land work, the continuous records of the magnetic observatories, five in number, were available, except for the time during which the instruments of the observatory at Baldwin, Kans., were being removed to Tucson, Ariz., the observatory at the former place being discontinued in October, 1909, and a new one established at the latter in November, 1909.

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[11] Rieu, "Catalogue of the Persian Mss. in the Library of the British Museum," 1879, Vol. 1, pp. 96–97.

SPECIAL ARTICLES

REDISCOVERY OF SOME CONRAD FORMS

T. A. Conrad in "Description of Cretaceous and Tertiary Fossils," published in part two of the Report on the United States and Mexican Boundary Survey, describes and figures the following cretaceous forms collected by Arthur Schott, ascribing them to the localities given.

Mactra texana,	Prairie between Laredo and Rio Grande City.
Cardium congestum,	Devils River.
Rostellaria? collina, *Rostellaria? texana,* *Natica collina,* *Natica texana,* *Buccinopsis parryi,*	Between Devils River and the Pecos.

The first-named locality is in the Eocene and at the others only rocks of Fredericksburg and Washita are exposed. These forms have not since been found in either locality named and I have not been able to find any record of their having been recognized, since the time of their description, anywhere else in this region, although, as will be shown later, one or two of them have been collected by other workers in this field.

In working over the collections made in January, 1909, by Messrs. W. F. Cummins and W. Kennedy along the Rio Grande below Eagle Pass, I found a number of fairly good specimens of each of the species named.

Our localities and collections are as follows:

Mouth of Cuevas Creek:
- *Rostellaria? (Volutomorpha) texana* Con.
- *Cardium congestum* Con.

One and one half miles above Las Isletas:
- *Mactra texana* Con.
- *Pholadomya* sp.
- *Buccinopsis parryi* Con.
- *Rostellaria? (Volutomorpha) texana* Con.
- Etc.

Wash 1 m. above Las Isletas:
- *Sphenodiscus pleurisepta* Con.
- *Ostrea cortex* Con.
- *Mactra texana* Con.

Pholadomya sp.
Cardium congestum Con.
Buccinopsis parryi Con.
Rostellaria? (*Volutomorpha*) *texana* Con.
Pugnellus sp. Etc.

Las Isletas:
Sphenodiscus pleurisepta Con.
Mactra texana Con.
Cardium congestum Con.
Turritella sp. Etc.

Arroyo Toro Colorado, 1 m. below Las Isletas:
Sphenodiscus pleurisepta Con.
Nautilus dekayii?
Ostrea sp.
Mactra texana Con.
Crassatella sp.
Cardium congestum.
Breviarca sp.
Buccinopsis parryi Con.
Pugnellus sp.
Natica collina Con.
Natica texana Con.
Rostellaria? (*Volutomorpha*) *texana* Con.
Etc.

This locality also furnishes a number of specimens of crabs.

A selection of specimens representing several of the species under discussion, together with a number of others occurring in the same beds, were submitted to Dr. T. W. Stanton, of the United States National Museum, and my identifications of the Conrad forms were confirmed by Dr. L. W. Stephenson, who states that the *Rostellaria?* of Conrad is a Volutomorpha.

Major Emory, in the first part of the Boundary Survey report, on page 68, gives a description of Las Isletas and the falls of the Rio Grande with a full-page illustration opposite. This description would indicate that the falls of the Rio Grande and Las Isletas were the same. The truth is that Las Isletas is located about the mouth of Castaño Creek, while the falls are some four miles lower down the river just below the mouth of Caballero Creek.

It will thus be seen that our collections were made from localities directly on the line of travel of the Boundary Survey party and it seems highly probable that the original specimens described by Mr. Conrad were in reality obtained from these same beds.

The horizon is the uppermost portion of our Escondido beds. The fossils are among the latest Cretaceous forms of which we have any present knowledge in this region.

The Cretaceous-Eocene contact is well shown three miles below Toro Colorado, just above the falls of the Rio Grande and on Caballero Creek.

The only other records I can find of any of these forms are as follows:

Professor G. D. Harris, in "The Tertiary Geology of Southern Arkansas," gives a list of fossils collected by Dr. C. A. White in 1887 at his camp eighteen miles southeast of Eagle Pass, Texas, which were supposed to be basal Tertiary. Among these there is a cardium which Mr. Harris figures both in this paper and later with his Midway fauna "Bulletin of American Paleontology, No. 4," without giving it a specific name.

This camp was probably at the Eagle Pass-Laredo road crossing near the junction of Cuevas and Peña creeks and on or near the Cretaceous-Tertiary contact. The cardium is unquestionably the *Cardium congestum* of Conrad, while the other forms named by Professor Harris are from the overlying Midway.

Mr. T. W. Vaughan in his Report on the Rio Grande Coal Fields of Texas gives a list of fossils collected 18½ miles southeast of Eagle Pass. This must also have been in the same vicinity. His list contains a form identified as "*Mactra* cf. *mooreana*" which, in view of our later discovery, may be more properly called *Mactra texana,* and *Cardium* cf. *eufalense* may be *Cardium congestum.*

E. T. DUMBLE

BACTERIOLOGICAL METHODS FOR THE ESTIMATION OF SOIL ACIDITY

THE general prevalence of acidity in the older soils of the United States has been the cause of increasing comment, within the past few years. It is well known that the tendency of cultivated soils to become acid is intensified by the use of commercial fertilizers, and, gen-

erally, by the more intensive methods in vogue in portions of the eastern states. Since profitable cropping becomes impossible in soils that are strongly acid, the liming of soils is now receiving a good deal of attention. The subject of lime and liming is freely discussed in the agricultural press, and the experiment stations are asked to supply farmers with detailed information as to the amounts and kinds of lime needed for different soil types, and for different systems of cropping. In view of the constantly increasing interest in lime and its application, it is desirable that reliable methods be provided for estimating the lime requirements of soils. The search for chemical methods that would supply the desired information was begun many years ago, and a considerable number of methods have been proposed as suitable for this work; unfortunately, however, agricultural chemists find themselves unable to decide on any chemical method that would give reliable results. Some years ago a method was proposed by Tacke that proved of certain value for the moor soils of Germany. More recently Süchting has attempted to improve the method by correcting certain defects in it, but even in its improved state the method leaves much to be desired; it is cumbersome and far from reliable. Similarly, methods have been proposed in the United States by Pettit and Hopkins and, also, by Veitch. These methods have been tested under different conditions, and have failed to give concordant results.

In view of the lack of a satisfactory method for the quantitative estimation of soil acidity, and in view of the evident need for a method of this character, it is eminently proper to make a careful study of new methods that seem at all promising. Among the new methods that could be suggested, for this work, the writer would include methods based on certain bacteriological reactions. It is well known that the development of bacteria in any culture medium is directly affected by the reaction of the latter. When the acidity of the medium is increased beyond a certain point, bacteriological development is retarded, or entirely stopped. For this reason, it appears evident that if to any neutral medium there be added increasing quantities of acid soil, a point will be finally reached when the acid in the soil added would preclude further development of the organisms. Following out this line of thought, the writer prepared a series of media of varying reaction. Several portions of bouillon were prepared and adjusted to the following reactions: (*a*) Neutral, (*b*) one half per cent. acid, (*c*) one per cent. acid, (*d*) one and a half per cent. acid, (*e*) two per cent. acid, (*f*) three per cent. acid.

When portions of these media were inoculated with pure cultures of *B. mycoides* or *B. subtilis,* growth occurred in the bouillon containing up to two per cent. of acid; beyond that the growth was very slight. When similar portions of bouillon had added to them one half gram, one gram, three grams, five grams and ten grams of soil, respectively, growth occurred in the different tubes depending on the amount of acid present in the medium, or that supplied by the soil. If, previous to the addition of the soil, the latter was mixed with ten per cent. of its own weight of calcium carbonate, growth occurred in all of the tubes, even those that had contained bouillon with three per cent. of acid.

These preliminary experiments demonstrated, therefore, that the amount of acid present in cultivated soils may be determined quite accurately by comparing bouillon of varying reactions with equivalent quantities of neutral bouillon containing varying amounts of soil. The proposed method may be utilized in still another direction, in that varying quantities of soil be added to measured amounts of bouillon, and, after sterilization, the bouillon be inoculated with a standard culture of ammonifying bacteria. At the expiration of a certain length of time the ammonia formed could be distilled off and determined in the usual way. Since the acid added by the varying quantities of soil would affect the development of the organisms to an unequal extent, the amounts of ammonia formed might be used as a fairly accurate measure of the retarding effect of the acid present in the soils. The quantitative rela-

tions may be established by comparing bouillon thus provided with varying amounts of soil with equivalent portions of bouillon, to which varying amounts of standard acid had been added.

Instead of employing ammonifying bacteria for estimating the acid present in soil samples, nitrogen-fixing species of the *Azotobacter* group could be used. It is well known that *Azotobacter* will grow by preference in neutral or slightly alkaline media; hence, mannite solutions could be made up and portions of it treated with varying amounts of soil as described above. After sterilization and cooling, the several portions could be inoculated from some pure culture of *Azotobacter*. At the end of a given length of time, the total nitrogen present could be determined and the amounts fixed used as a guide in measuring the retarding effect of the acid present in the soil sample. In the same way, nitrifying or other bacteria could be utilized for the quantitative estimation of soil acidity. It is expected that the data accumulated by us will be available for publication at an early date.

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AN INTERESTING OLD WEAVING TECHNIC

ON a recent expedition of the American Museum to the Pima-speaking tribes of southern Arizona there was found the remnant of an old technic in basket-work which has almost entirely disappeared from this people.

It is a crude wrapping of a pliable binding element over stiff slats which are arranged in parallels—a wrapped weaving and found with three variations.

It appears on a few old house doors, shelves, cradles and cages in the out-of-the-way villages where the people have still preserved the early mode of construction and it seems the simplest way of uniting stiff slat-like strips by means of a soft pliable binding element.

This binding element was formerly of thong or native string—both occasionally met with now—but more recently it is of White man's rope, strips of cloth or even wire. The slats are generally the smooth, light ribs of the giant cactus Saguara. These are placed in a parallel series, while in the simplest forms of wrapping the binding element passes forward over two slats on the outside, backward over one on the inside and then repeats the process, thus forming a simple wrapped weaving. When greater strength is needed an extra slat is placed perpendicularly across the parallel series and bound to them by each wrap of the binding element, which in more frequent varieties gives an extra turn about each slat. This last technic is known as lattice wrapped weaving.

The possible evolution of the last crude basket technic from the simple process of the tying of twigs and fibers in their latticed house construction is interesting; as well as a similar development of the wrapped weaving from the plain bindings on one type of their cradles.

Indeed the thought suggests itself, might it not be possible that this crude wrapped weaving, because of its great simplicity, was one of the earliest to develop, especially in regions as destitute of suitable basket material as the desert country of the Pima? May not this technic hold a place with the others which lay claim to be the earliest technics—plaiting, with its over and under passing strips; wicker, with its interlacing twigs; wattling, with its twining elements?

Lattice wrapping repeats itself among the wild tribes in a number of the Malaysian Islands in crude traps and baskets, and on the Lower Congo in more refined basket work. Could its distribution through the desert region of America during early times be more closely traced, no doubt, we would find it a frequent technic, for it appears as far south as Mexico in the wagon box of the old ox-cart. A close surface of the same technic also exists to the north among the Pomo, the Nez Perce, the Makah and on some of the old Salish blankets.

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SOCIETIES AND ACADEMIES

THE HELMINTHOLOGICAL SOCIETY OF WASHINGTON

The fifth regular meeting of the society was held in the rooms of the zoological division of the Public Health and Marine Hospital Service on March 14, 1911, Dr. Stiles acting as host and Dr. Ransom as chairman. The following foreign corresponding members were elected: Raphael Blanchard, Max Braun, Otto Fuhrmann, I. Ijima, L. A. Jägerskiöld, S. J. Johnston, Robert T. Leiper, Otto von Linstow, Arthur Looss, Max Luehe, Sir Patrick Manson, Francesco Monticelli, L. G. Neumann, George H. F. Nuttall, Corrado Parona, Edoardo Perroncito, Theodor Pintner, Alcide Railliet, Arthur E. Shipley and Fritz Zschokke.

Dr. Garrison gave a summary of a report by Surgeon C. S. Butler, U. S. Navy, and himself upon the parasites found at autopsy upon dogs, cats and rats at the U. S. Medical School during the past year. Twelve dogs, ten cats and ten rats (*Mus decumanus*) were examined with the following results:

Dogs—*Filaria* (species undetermined), two infections; *Ascaris canis*, five infections; *Trichuris depressiusculus*, one infection; *Ancylostoma caninum*, five infections; *Tænia pisiformis*, three infections; *Dipylidium caninum*, six infections.

Cats—*Ascaris canis*, eight infections; *Tænia teniæformis*, two infections; *Dipylidium caninum*, six infections.

Rats—*Trypanosoma lewisi*, one infection; *Trichinella spiralis*, one infection; *Trichosoma hepaticum*, four infections; *Trichosoma crassicauda*, seven infections (two bladders not examined); *Heterakis spumosa*, eight infections; *Hymenolepis nana*, one infection (in white rat); *H. diminuta*, five infections; *Cysticercus fasciolaris*, eight infections.

In addition, the examination of about twenty cock-roaches showed infections with *Amœba blattæ* and numerous ciliates and flagellates. No gregarines were found.

Dr. Stiles called attention to the desirability of using fresh material for parasite study in class work.

The secretary read a short note by Mr. Crawley on *Trypanosoma americanum*. This parasite has been found in dried smears of centrifuged bovine blood. This is of interest, since the trypanosome has hitherto been found only in bouillon cultures of the blood. The morphology of the organism as found in the fresh blood is the same as that of specimens appearing in culture tubes.

Mr. Hall presented a paper entitled "The Limitations of Fecal Examination as a Means of Determining Existing Parasitism of the Digestive Tract." Certain writers have claimed a relation between the number of parasites present in any host and the number of eggs in a given amount of fæces from that host. This does not appear to be a general truth with wide application. Besides the element of chance in the detection of eggs, there are certain conditions which permit of parasitism of the digestive tract without eggs in the feces to indicate it. Some of these conditions are: (1) Infections with nematodes, usually light, where only males are present; (2) recent infections, at times heavy, in which the infecting larvæ of any species have not yet reached the egg-producing stage; (3) interruption of egg-production, as by breaking of strobila in tapeworms, or cessation of egg-production, as in the case of barren nematodes; (4) irregularity of passage of eggs from the host, due to purging, passage of mucus, diarrhœa, use of thymol or alcohol, etc. Consecutive and careful examinations of the fæces of a given animal show days when eggs of various kinds are abundant and days when they are scarce or missing. This would be particularly true or cestodes. Negative examinations must be considered doubtful and must be checked at intervals if infection is suspected.

Dr. Stiles presented a paper entitled "A Comparison of New England and Southern Mills with Reference to Natural Advantages and the Presence of Parasitic Diseases."

The sixth regular meeting of the society was held in the rooms of the zoological division of the Public Health and Marine Hospital Service on April 11, 1911, Dr. Stiles acting as host and Dr. Garrison as chairman.

The following American corresponding members were elected: F. D. Barker, Cooper Curtice, C. A. Kofoid, E. Linton, W. S. Nickerson, H. S. Pratt, Allen J. Smith, L. D. Swingle, A. E. Verrill, H. B. Ward, Creighton Wellman, D. G. Willets and R. T. Young.

Dr. Stiles presented a note on a case of poisoning by the Portuguese man-of-war. The poisoning had been attributed to the fish which commonly accompanies this cœlenterate. This was an error, as the stings were due to the jellyfish itself. These stings were very painful and persisted for some time in spite of treatment. The subject of poisoning by jellyfish is one that has not received adequate study.

Dr. Stiles presented a second note on the findings in fecal examination of 82 southern school children aged six to twelve years. Infection with hookworm was found in 5 per cent., with *Ascaris* in 41 per cent., with *Trichuris* in 15 per cent. and with *Hymenolepis nana* in 6 per cent.

Dr. Ransom presented a paper entitled "A New Cestode from an African Bustard" in which was described a new species and genus, belonging to the family Davaineidæ. The specimens on which the description is based were collected by Mr. Loring, of the Roosevelt African Expedition, in British East Africa, from the intestine of a bustard, *Neotis caffra*. The worms are characterized particularly by the presence of ten to twelve rows of very numerous hammer-shaped hooks on the rostellum. Parauterine organs are present in gravid segments. The complete paper will appear in a forthcoming publication of the Smithsonian Institution.

Mr. Hall presented the following notes:

The Coyote as a Host of Multiceps multiceps.

Curtice in 1890 first suggested that the adult gid tapeworm might occur in the coyote. In 1910 Hall noted the likelihood of this being true and pointed out that if it were true, then the most essential step in the prophylaxis of gid was the destruction of the heads of sheep dying of this disease, since the other prophylactic measure which is commonly advocated, the administration of tapeworm medicines to dogs, is obviously inadequate if coyotes also carry the parasite. In another article in the same year Hall noted that we had absolutely no evidence as to whether the coyote carried the adult worm, and that the only known host is the dog. The data regarding the blue fox and red fox as hosts of the gid tapeworm are quite inadequate and these animals must be considered doubtful hosts on the evidence at hand. There is no record of any sort as regards the wolves, martin or polecat, all of which have been noted as possible hosts.

To settle the question as to whether the coyote carried the adult gid tapeworm, a matter of considerable interest in that the coyote is the most common of the wild carnivora which prey upon western sheep, the experiment was tried of feeding the larval *Multiceps multiceps,* recovered by operation from the brain of a giddy sheep, to two coyotes. The sheep was operated on April 4, 1911, and the cœnurus was fed to the coyotes shortly after the operation, each animal receiving about half of the cyst. One coyote was found dead the morning of April 10. Post-mortem examination showed death to be due to septicæmia. The entire length of the small intestine showed severe ecchymotic hemorrhage. Fifty-two heads of *M. multiceps* were recovered from the intestinal contents. A comparison of these worms after six days' development with some recovered from a dog after ten days' development shows the worms had established themselves and were developing normally. They were still very small, of course, but there is no reason to suppose that they would not have developed to maturity if the coyote had lived.

The coyotes, *Canis nebracensis,* according to Dr. Bailey, of the Biological Survey, were obtained in northern Montana in the area where gid is enzootic and the coyote, therefore, must be considered, in view of the experimental findings, as sharing with the dog the responsibility for carrying the gid parasite and maintaining the gid disease in that state.

A Third Case of Multiceps serialis in the Squirrel.

In a list of occurrences claimed for the larval *Multiceps serialis,* Hall in 1910 noted that Cobbold in 1864 had recorded *M. serialis* under the name by which it is more commonly known, *Cœnurus serialis,* from an American squirrel in England, the host being specified in a later article by Cobbold in 1879 as probably *Sciurus vulpinus,* and that Cagny in 1882 had recorded a second case from the squirrel, *Sciurus vulgaris,* in France. Hall accepted these records as probably correct. It was a fair assumption that Cobbold's cœnurus would be the same species as that found in another rodent, the rabbit, rather than the species found in the sheep. He did not specify whether the American squirrel was merely an American species or the animal in question was actually from America. If it was infected in America at that date, it would be much more likely that the parasite was *M. serialis* than *M. multiceps,* as the latter form is much the more rare and limited in distribution now and probably was even more so then. Kunsemüller, in an article in 1903, thinks this cœnurus of Cobbold's was probably *M. serialis.* Cagny found his cœnurus in a squirrel which had been caught young and kept three years. His specimen was examined by Mégnin and Railliet, both of whom pronounced it *Cœnurus serialis.*

In the article already noted, Hall stated that it was to be expected that a parasite like *M. serialis*

would be rare in a host like the squirrel, as the squirrel's food is of such a nature, consisting as it does largely of nuts, that fæcal contamination by carnivorous hosts of the adult worm would only occur very rarely.

Recently the writer has produced the larval *M. serialis* in an American squirrel, *Sciurus carolinensis*, by feeding proglottids of the adult worm from the dog. This proof that the squirrel may act as host of *M. serialis* warrants us in accepting Cobbold's and Cagny's cases without reservation.

The squirrel was fed December 29, 1910, with fifteen proglottids collected eight days before from the fæces of a dog infected with the adult *M. serialis* by feeding the larval form from the rabbit. The proglottids had been kept in water from the time they were collected. Superficial examination indicated that some of the proglottids were gravid and some were not. As the proglottids were injected into the mouth the squirrel stored part of them in the cheek pouches, but it was certain that the rotten proglottids would release some of the eggs and that these would be swallowed even though the proglottids might be rejected later. Ninety-two days after ingesting the proglottids, the squirrel died. It had been active up to two or three days before death and had then remained down, clawing at its jaws occasionally. Before the skin was removed, the swellings on the abdomen, back and legs plainly showed the presence of the parasite cysts. After skinning the animal, the cysts were found on the lower abdomen, the middle of the back, the right shoulder and side, the right hind quarter, the left thigh, the left hind quarter, the left calf and the left breast, side and shoulder. An incision along the abdomen did not disclose any on the viscera. The thorax was not opened, and the specimen was preserved intact except for two cysts which fell out from a superficial position under the skin on the abdomen. One of these was cut in two and both cysts were put in the ice-box at a temperature of 12 to 14° C. for 44 hours. At the end of that time they were immersed in warm water. The one which had been cut in two showed no sign of movement and was apparently dead. The other cyst, which had been punctured and lost a large part of the contained fluid, showed the contractile movements characteristic of bladder-worms and was cut in two and fed to two dogs.

The cysts showed the linear arrangement of scolices which is often found in *M. serialis* and from which the species takes its name. The identification of the parasite in this case is based less on this, however, than on the fact that it was produced by feeding the adult worm.

The secretary read a paper by Mr. Foster entitled "Some Experiments in the Development of *Tænia teniæformis* (Bloch, 1780) Stiles and Stevenson, 1905; with an Account of Coccidiosis in the Cat." By feeding experiments the larval parasite was developed in the rat from the cat tapeworm and the cat tapeworm developed in turn from these larvæ. Attempts to infect dogs failed. Some differences were found in the larval and adult hooks. In general the results agreed with those of earlier experiments. A coccidium found in the cat proved to be much larger than *Coccidium bigeminum*, the only form hitherto reported from the cat. It resembled *Eimeria stiedæ* in size but differed from it in the piriform shape of the oocyst and the absence of residual protoplasm.

Dr. Garrison gave a demonstration of a new intestine tray for autopsies. This consists of a copper sheet 30 inches long, 10 inches wide at the broad end and 5 inches wide at the narrow end, with a raised edge an inch and a half high, and with a steel rod attached to the raised edge where it is prolonged along the broad end and running above the tray to the narrow end where the rod rests on the body of the tray, the end of the rod curving downward over the narrow end of the tray. At the ends the tray is bent down to form vertical supports 6 inches long at the wide end and 4 inches at the narrow end. The floor of the tray is convex upward, the middle being about an inch higher than the sides. In use the tray is placed over two pails or jars with a slight slope downward toward the narrow end, or else the tray is stood up in two shallow dishes, the slope being obtained by virtue of the greater length of the vertical support at the broad end.

The intestines are placed in the jar or other receptacle at the lower narrow end of the tray and one end of the intestine is pulled up on the steel rod. The section of intestine held by the rod is then cut open and falls on the floor of the tray where it can be examined and washed, the contents going into the lower jar. When one section of intestine is examined it is placed in the upper jar at the same time that a fresh section is pulled on to the rod. The size of the rods varies with the size of the animals examined. To facilitate detection of parasites the tray should be painted or enameled black. The tray can be easily cleaned and sterilized.

Maurice C. Hall,
Secretary